

## TAPE CARTRIDGE

### BACKGROUND OF THE INVENTION

#### Field of the Invention

5           The present invention relates to a reel-typed tape cartridge used for a magnetic recording and reproducing apparatus.

#### Description of the Prior Art

          A reel-typed tape cartridge used for a magnetic  
10   recording and reproducing apparatus is provided with a  
brake-locking member for preventing a tape reel from being  
rotated in order to maintain a braked state when the tape  
cartridge is not used. Fig.10 is a vertical sectional view  
of a conventional one-reel typed tape cartridge. A tape  
15   cartridge 100 in Fig.10 is produced so as to prevent the  
tape from being loosened as follows. A brake-locking member  
103 biases a brake-locking member 103 using a spring 101  
in a direction of an arrow A in Fig.10, in which a teeth  
portion 103 of the brake-locking member 103a is mated with  
20   a teeth portion 104 being connected to an inner surface side  
of a hub 102a of a tape reel 102, resulting in that rotation  
of the tape reel 102 is prevented when the tape cartridge  
is not used, e.g. when the tape cartridge 100 is preserved,  
and further the rotation of the tape reel 102 owing to  
25   unexpected vibration or the like when the tape cartridge  
100 is preserved and the loosening of the tape owing the  
rotation thereof is prevented. Further, when the tape

cartridge 100 is used, a brake-releasing plate 105 is pushed up, thereby lifting the brake-locking member 103 upwardly in Fig.10 against a biasing force using the spring 101, releasing the mating state between the teeth portion 103a and the teeth portion 104, resulting in performing lock-releasing operation.

Fig.11A is a partial front view showing a state where the teeth portion 104 at the side of the tape reel 102 is mated with the teeth portion 103a of the brake-locking member 103. Fig.11B is a partial front view showing a state where the mating state is released. As shown in Fig.11A, the teeth portion 104 and the teeth portion 103a, both are shaped in an elongated triangle teeth manner, and the teeth of them are mutually mated therewith.

However, according to such a conventional teeth-mating configuration as shown in Fig.11A, the teeth and the opposite teeth is obliquely contacted, so that when a force is worked from outside owing to vibration or the like, the mating between the teeth and the opposite teeth is unfitted, resulting in that the tape reel 102 is unexpectedly rotated, and the tape becomes readily to be loosened when the tape cartridge is not used e.g. when the tape cartridge is preserved. Thus, if a function for preventing the tape from being loosened is not sufficiently operated and the tape is loosened at an inside of the cartridge case, then the tape will be readily folded and/or jammed.

In order to prevent the tape from being loosened, the

teeth are made to be longer and the teeth and the opposite teeth have only to be deeply mated. However, in this case, following working will occur. By pushing up the brake releasing plate 105, the brake-locking member 103 is moved  
5 when the tape cartridge is used. Thereby, when the teeth portion 103a of the brake-locking member 103 is detached from the teeth portion 104 at the side of the tape reel 102 as shown in Fig.11B so that the mating state is released, the gap a becomes narrower between the teeth portion 103a  
10 and the teeth portion 104, because the stroke for the releasing is constant while the above-mentioned teeth are long in themselves.

Here, even when the gap a becomes narrower, if the gap a is always kept be constant, there will not occur any  
15 big problem. In fact, the brake-locking member 103 is biased against the brake releasing plate 105 using the spring 101 supported by the cartridge case, and the brake-locking member 103 is contacted with the brake releasing plate 105 at a bearing portion 101a whose center portion is convex. Thus,  
20 if a pressure balance of the spring 101 is not kept, then the brake-locking member 103 will be inclined. Further, the teeth portion 103a of the brake-locking member 103 is in contacted with the teeth portion 104 of the rotating tape reel 102, because the gap a is originally narrow. Thus, such  
25 a configuration might cause an erroneous operation.

Additionally, the bearing portion 101a located at a center of the brake-locking member 103 is rotated and

contacted with the brake releasing plate 105 and biased using the spring 101 to receive a pressure. Thus, if a using time of the tape cartridge passes to some extent, the bearing portion 101a may be sometimes worn. The gap a in Fig.11B becomes narrower owing to such wearing defect, so that the teeth portion 103a is contacted with the teeth portion 104 of the rotating tape reel 102. Thus, in such a same way as above-mentioned, such a configuration might readily cause an erroneous operation.

#### SUMMARY OF THE INVENTION

The object of the present invention is to provide a tape cartridge in which the mating state of teeth at the side of a brake-locking member with teeth at the side of a tape reel is hard to become unfitted when the tape cartridge is not used, the unexpected rotation of the tape reel can be securely prevented, the loosening of the tape is hard to occur, and the strength of the teeth is enhanced.

Another object of the present invention is to provide a tape cartridge in which a gap between the teeth at the side of the tape reel and the teeth at the side of the brake-locking member when the tape cartridge is used can be secured as wide as possible, resulting in that the contact between the teeth at the side of the tape reel and the teeth at the side of the brake-locking member is prevented while the tape reel is rotating, so that an error operation can be prevented.

A tape cartridge according to the present embodiments is constituted so that the tape cartridge comprises: a tape reel around which a tape-shaped recording medium is wound, which is rotatably housed, and which has a reel teeth portion; and a brake-locking member having a brake teeth portion capable of being mated with the reel teeth and releasing the mating state so that rotation of the tape reel is prevented when the tape cartridge is not used and is possible when the tape cartridge is used; wherein the reel teeth portion and the brake teeth portion respectively have a plurality of teeth projected from a base portion, each of the teeth have a taper portion which is inclined toward at least one direction from a tip part of the teeth, and vertical portions extending in a substantially vertical manner from an end terminal and the tip part of the taper portion or from both end terminals of the taper portion to the base portion; and at least one portion of each of the teeth is constituted so that the vertical portion is opposing to the vertical portion at an opposite side at the time of the mating.

According to this tape cartridge, each tooth of the reel teeth portion and the brake teeth portion have a vertical portion extending in a substantially vertical manner from an end terminal and the tip part of the taper portion or from both terminals of the taper portion to the base portion; and at least one portion of each of the teeth is constituted so that the vertical portion is opposing to the vertical portion at an opposite side at the time of the mating.

Consequently, when the tape cartridge is not used, the mating state of the teeth at the side of the brake-locking member with the teeth at the side of the tape reel becomes hard to be unfitted, the unexpected rotation of the tape reel is securely prevented, the loosening of the tape is hard to occur, and a sectional area of each of the teeth by the taper portion and the vertical portion can be securely large, resulting in that strength of the teeth can be enhanced. Further, when the teeth and the opposite teeth are about to be mutually mated, the tip part of each of the teeth is guided and moved using the taper portion, resulting in that the mating of the teeth with the opposite teeth can be readily and securely performed.

A configuration of each of the teeth is explained as follows. The taper portion may be inclined at both sides from the tip part and further the vertical portions at both sides may be extended from both end terminals of the taper portion to the base portion. Further, the taper portion is inclined toward one of the both sides of the tip part, one of the vertical portions is extended from the end terminal of the taper portion to the base portion, and the other one of the vertical portions is extended from the tip part to the base portion. The tip part of each of the teeth is constituted at its apex or a flat portion.

Further, the tape reel and the brake-locking member are constituted so that they are relatively moved so as to have a gap between the reel teeth portion and the brake teeth

portion in order to release the mating state. In such a configuration, as above-mentioned, when the tape cartridge is not used, the teeth at the side of the brake-locking member and the teeth at the side of the tape reel become hard to  
5 be unfitted and a sectional area of the tooth can be securely large, resulting in that a gap between the reel teeth portion and the brake teeth portion can be securely large, and contact between the reel teeth portion and the brake teeth portion can be securely prevented while the tape reel is rotating,  
10 so that an error operation can be prevented when the tape cartridge is used. Thereby, reliability can be enhanced when the tape cartridge is used.

Further, it is preferable that the tape cartridge is provided with a biasing member which biases the brake-locking  
15 member for establishing the mating state, and an engaging portion which is engaged with a driving member of an external device for rotational driving of the tape reel when the tape cartridge is used, in which the brake-locking member is moved against a biasing force of the biasing member when the driving  
20 member is engaged with the engaging portion. Thereby, when the tape cartridge is mounted to the exterior device in order to use the tape cartridge, the driving member is engaged with the engaging portion at the side of the tape cartridge thereby moving the brake-locking member, resulting in that  
25 the mating state of the reel teeth portion with the brake teeth portion can be released.

Further, the tape cartridge can be constituted so that

the end portion at the side of the tape reel of the  
brake-locking member is abutted on a rotating portion  
integrally with the tape reel at the vicinity of the rotating  
center portion of the tape reel. Thereby, even if the  
5 abutting portion is worn while the tape cartridge is being  
used, as above-mentioned, the gap between the reel teeth  
portion and the brake teeth portion can be widely secured  
when the tape cartridge is used, allowance degree becomes  
greater with respect to an worn amount.

10 Further, the tape cartridge can be constituted so that  
the tip part is contacted with a bottom surface of the base  
portion of the opposite side at the time of the mating. In  
this case, provided that height of each of said teeth from  
said base portion to the tip part is defined by H1, height  
15 of the vertical portion H (distance from the base portion  
to the terminal end of the taper portion) is satisfied by  
following equation:

$$0.6 \times H1 \leq H \leq 0.95 \times H1 \dots(1)$$

The height H of the vertical portion is set to be equal  
20 to or 60% higher than the height (entire height) H1 from  
the base portion of the teeth portion to the tip part. Thereby,  
opposing areas between the vertical portions can be secured  
at the time of the mating. Further, the height H is equal  
to H1 or 95% lower than H1. Thereby, an inclination angle  
25 can be secured to such an extend that the guide effect can  
be performed at the taper portion.

Further, the tape cartridge can be constituted so that



the vertical portion is contacted with the vertical portion at the opposite side so that the tip part is not contacted with a bottom surface of the base portion at the opposite side at the time of mating. In this case, The tape cartridge  
5 is constituted so that, provided that height from the base portion to the tip part is defined by  $H_1$ , a contact height  $\Delta H$  at a mutually contacting portion between the vertical portions is satisfied with following equation:

$$0.2 \times H_1 \leq \Delta H \leq 0.9 \times H_1 \dots(2)$$

10 The contact height  $\Delta H$  at a mutually contacting portion between the vertical portions is set to be equal to or 20% higher than  $H_1$ . Thereby, the contact height  $\Delta H$  at a mutually opposing and contacting portion between the vertical portions is set to be equal to or 20% higher than the height (entire  
15 height) from the base portion of the teeth portion to the tip part, resulting in that the mutually opposing contact areas at the time of the mating can be secured. Further, the contact height  $\Delta H$  is set to be equal to or 90 % lower than the height (entire height), resulting in that an  
20 inclination angle can be secured to such an extent that the guide effect can be performed at the taper portion.

Additionally, it is preferable that the reel teeth portion and the brake teeth portion are constituted so that a plurality of the teeth are arranged in a circular manner  
25 by a constant pitch having a constant angle with relative to its center.

#### BRIEF DESCRIPTION OF DRAWINGS

Fig.1 is an exploded view in perspective of a tape cartridge according to an aspect of the present invention.

Fig.2 is a vertical sectional view of the tape cartridge in Fig.1, which shows a state where locking of the tape reel is released when the tape cartridge is not used.

Fig.3 is a vertical sectional view of the tape cartridge in Fig.1, which shows a state where locking of the tape reel is released when the tape cartridge is used.

Fig.4 is a plan view partially showing a large number of teeth by which the teeth portions of the brake-locking member are arranged in a circular manner, seen from a side of its bottom surface.

Fig.5 is an elevational view partially showing the teeth constituting the teeth portion of the brake-locking member in Fig.1 and the teeth portion of the hub of the tape reel.

Fig.6 is a view showing a gap formed between tip parts of each of the teeth at the time of releasing the mating state of the teeth when the tape cartridge in Fig.1 is used, comparing such a gap with a gap formed in the conventional art.

Fig.7 is an elevational view showing a modified example of a teeth construction in which a height H at a vertical portion of each of the teeth is set so as to be somewhat lower in a same way as shown in Fig.5.

Fig.8 is an elevational view showing another modified

example of a teeth construction in which a height H at a vertical portion of each of the teeth is set so as to be somewhat higher in a same way as shown in Fig.5.

Fig.9 is an elevational view showing further another  
5 modified example of a teeth construction in which a height H at a vertical portion of each of the teeth construction is changed using a teeth portion 35 and a teeth portion 51 in a same way as shown in Fig.5.

Fig.10 is a vertical sectional view of a tape cartridge  
10 of the conventional one-reel-typed tape cartridge.

Fig.11A is a partial elevational view showing a state where the teeth portion of the tape reel side and the teeth portion of the braking lock member side are mutually mated, in the conventional tape cartridge, and Fig.11B is a partial  
15 elevational view showing a state where such a mating state is released.

Figs.12A, 12B, 12C, and 12D respectively show further modified examples of the teeth configuration.

Fig.13 shows an elevational view showing a further  
20 modified example of the teeth configuration.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, description will be explained about embodiments of the present invention with reference to the  
25 accompanying drawings. Fig.1 is an exploded view in perspective of a tape cartridge according to an aspect of the present invention. Fig.2 is a vertical sectional view

of the tape cartridge in Fig.1, which shows a state where locking of the tape reel is released. Fig.3 is also a vertical sectional view of the tape cartridge in Fig.1, which shows a state where locking of the tape reel is released. Note  
5 that Fig.1 also shows a perspective view of an upper case 1 and a hub portion 32 respectively seen from their backsides.

The tape cartridge in Fig.1 is constituted in a rectangular and plane-shaped one-reel type manner, which is provided with the upper case 1 and a lower case 2. The  
10 tape cartridge has a tape reel 3 on which a magnetic recording tape being a tape-shaped recording medium (which is hereinafter sometimes merely called "tape") is wound at an inside of the tape cartridge. When mounted to a recording and reproducing apparatus, the tape cartridge is constructed  
15 so that the tape reel 3 can be rotated. The upper case 1 and the lower case 2 can be respectively produced by molding process using resin material.

The tape reel 3 is provided with an upper flange 31, a lower flange 33, and a hub portion which is formed integrally with the lower flange 33. And on a circumferential surface  
20 of the hub portion, a tape-shaped magnetic recording medium is wound. Also, as shown in Fig.1, a circle-shaped metal plate 34 made of soft magnetic material is provided integrally with a lower surface 32a of the hub portion 32. Engaging  
25 teeth 34a which engages with teeth portion of a driving member 85 (see Fig.3) at the side of a recording and reproducing apparatus are provided at the periphery of the metal plate

34, which are divided into three sections in its circumferential direction. A plurality of holes 34b penetrate through the opposite surface to the lower surface 32a between the engaging teeth 34a. The metal plate 34, the  
5 engaging teeth 34a, and the plurality of holes 34b penetrate through a penetrating hole 21 of the lower case 2 to be exposed for an outside.

A teeth portion 35 is provided so as to be separated in its circumferential direction at a plurality of locations  
10 on a backside face of the lower surface 32a at an inside of the hub portion 32. Here, the teeth portion 35 has a large number of teeth 36 (see Fig.5) which are mated and engaged with a teeth portion 51 of a brake-locking member 5 and which are arranged in a circle manner. The teeth portion 35 can  
15 be produced by molding process using resin material such as polycarbonate (PC) or the like. In this case, by mixing glass fiber into the resin material, its strength may be enhanced.

As shown in Fig.1 and Fig.2, the brake-locking member  
20 5 is arranged at an inside of the hub portion 32. The large number of teeth 54 (see Fig.5) are provided with the teeth portion 51 which is arranged in a circular manner; a cross-shaped engaging hole 5a being formed on an end surface of a cylinder whose diameter is smaller than the diameter  
25 of the teeth portion 51; an end portion 5b at the periphery of the cross-shaped hole 5a; and a ring-shaped groove 5c which is formed so that an end portion 4b of a brake-locking

spring 4 is accommodated at a backside face of the teeth portion 51; so that the large number of teeth 54 are mated and engaged with the teeth portion 35 of the hub portion 32. The brake-locking member 5 can be produced by molding process using resin material such as polyacetal (POM) or the like.

The brake-locking member 5 is, as shown in Fig.1 and Fig.2, mounted to the upper case 1 so that a plurality of engaging projecting portions 1c being provided so as to be upright to an inner surface 1a of the upper case 1 are inserted into the cross-shaped hole 5a, so as to be movably engaged in a vertical direction of each of drawing papers of Fig.1 and Fig.2. A tip end 4a of the brake-locking spring 4 is fitted with ring-shaped grooves 1b of the inner surface 1a of the upper case 1. And the brake-locking spring 4 is located between the ring-shaped grooves 1b of the upper case 1 and the ring-shaped grooves 5c of the brake-locking member 5, and always biases against the brake lock member 5 in the direction of an arrow B in Fig.2, so that the teeth portion 51 and the teeth portion 35 of the hub portion 32 are mutually mated and engaged, resulting in preventing the tape reel 3 from being rotated to establish a braking state.

A brake releasing member 6 is arranged between the hub portion 32 and the brake-locking member 5, which is provided with a main plate 6a and a plurality of leg portions 6b which are projected downwardly in Fig.1 from a plurality of portions at the periphery of the main plate 6a. The

plurality of leg portions 6b are inserted into a plurality of holes 34b at the lower surface of the hub portion 32. When the tape cartridge is mounted to the recording and reproducing apparatus, the leg portion 6b of the

5 brake-releasing member 6 is lifted up upwardly by pushing them from below in Fig.1. Thus, as shown in Fig.3, the brake-locking portion 5 is, by way of a pressure equalizing plate 61 of the brake-locking member, lifted up upwardly against a biasing force of the brake-locking spring 4 at

10 a center of a convex bearing portion 52 at the center, resulting in that the end portion 5b is moved to an unlocked location so as to approach to the inner surface 1a.

The tip end 83 (represented by a dotted line in Fig.1) of the magnetic recording tape which is wound on the tape

15 reel 3 is fixed to leader members 8. In the leader members 8, the tip end 83 of the magnetic recording tape is wound on a pin member 81, and from above a C-shaped cramp 82 is fitted therewith to establish a fixing state. When the tape cartridge is mounted to the recording and reproducing

20 apparatus, the leader members 8 are held using a holding member at the side of the apparatus, and drawn from a tape drawing opening 73 (see Fig.1) to the side of the apparatus.

Further, the tape drawing opening 73 is opened and closed using a door member 7. The door member 7 is biased

25 toward a direction where the tape drawing opening 73 is always closed.

Next, description will be explained about a mating

configuration among a large number of teeth which constitutes the teeth portion 51 and the teeth portion 35, referring to Fig.4 and Fig.5. Fig.4 is a plan view partially showing a large number of teeth by which the teeth portions 51 of the brake-locking member 5 are arranged in a circular manner.

Fig.5 is an elevational view partially showing the teeth constituting the teeth portion 51 of the brake-locking member 5 and the teeth constituting the teeth portion 35 of the hub portion 32 of the tape reel 3, respectively.

As shown in Fig.4, the teeth portion 51 of the brake-locking member 5 is constituted by the large number of teeth 54 which are formed along a circumferential portion of a circular surface 53 of the brake-locking member 5 (a surface facing to the side of the tape reel 3 in Fig.2 and Fig.3). Each of the teeth 54 is extended from the circumferential portion of the circular 53 toward a center p (see Fig.4) in a radial manner and in a linear manner by a desired length, and formed at the entire circumferential portion, mutually having a constant pitch angle designated by  $\theta$ . Also, a lateral surface of each of the teeth 54 is constituted so that the height of the lateral surface is gradually lower from the circumferential side of the circle surface 53 toward the center p (see Fig.4) as shown in Fig.2 and Fig.3.

Further, the teeth portion 35 (see Fig.1) being provided so as to be divided at an inside of the hub portion 32 of the tape reel 3 is constituted in a substantially same



manner as the teeth portion 51 so as to be able to be mated with the teeth portion 51 in Fig.4. At the time of the mating, the teeth 36 (see Fig.5) constituting the teeth portion 35 is interposed between the teeth 54 and any other teeth 54.

5           As shown in Fig.5, each of the teeth 54 of the teeth portion 51 of the brake-locking member 5 is formed in an approximately pentagonal shape, seen from a front portion at the circumferential side of a circular surface 53. In other words, each of the teeth 54 has a taper portion 55 and a vertical portion 56. The taper portion 55 is slanted  
10           at both sides from an apex portion which is a tip end 55a, and has substantially symmetrical shape with relative to an axis line in a longitudinal direction of drawing of Fig.5. The vertical portion 56 is extended in a substantially  
15           vertical manner from both terminal ends 55b of the taper portion 55 toward a base portion 57.

          Each of the teeth 36 at the side of the tape reel 3 is also formed in an approximately pentagonal shape. Likewise, each of the teeth 36 has a taper portion 37 and  
20           a vertical portion 38. The taper portion 37 is slanted at both sides from an apex portion which is a tip end 37a, and has substantially symmetrical shape with relative to an axis line in a longitudinal direction of drawing of Fig.5. The vertical portion 38 is extended in a substantially vertical  
25           manner from both terminal ends 37b of the taper portion 37 toward a base portion 39.

          When the teeth portion 51 is mated with the teeth portion

35, as represented by a double-dot line in Fig.5, the teeth  
54 of the teeth portion 51 is fitted with a gap between the  
teeth 36 and the other teeth 36 of the teeth portion 35 lying  
at the opposite side, and the tip end 55a is contacted on  
5 a bottom surface 39a of the base portion 39, while the teeth  
36 of the teeth portion 35 is fitted with a gap between the  
teeth 54 and the other teeth 54, and the tip end 37a is contacted  
on a bottom surface 57a of the base portion 57. Then, the  
vertical portion 56 of the teeth 54 and the vertical portion  
10 38 of the teeth 36 are partially opposed and contacted.

Further, as shown in Fig.5, if the height from the  
base portion 57 of the teeth 54 to the tip end 55a is defined  
by H1, it is preferable that a height designated by H of  
the vertical direction from the base portion 57 to the terminal  
15 end 55b of the taper portion 55 is satisfied with following  
equation. Note that it is preferable that the teeth 36 is  
also satisfied with such a relationship.

$$0.6 \times H1 \leq H \leq 0.95 \times H1$$

According to the tape cartridge shown in Fig.1 to Fig.5,  
20 when the tape cartridge is not used, e.g. when the tape  
cartridge is preserved, the brake-locking member 5 is biased  
using the brake-locking spring 4 to be moved to a locking  
position as shown in Fig.2. And each of the teeth 54 of the  
teeth portion 51 of the brake-locking member 5 and each of  
25 the teeth 36 of the teeth portion 35 of the hub portion 32  
of the tape reel 3 are mutually mated and engaged as represented  
by the solid line and the two-dotted line in Fig.5, resulting

in that the tape reel 3 will lie in a braked state, i.e. cannot be rotated, so that an unexpected rotation can be prevented and the loosening of the magnetic recording tape can be prevented. Further, the vertical portion 56 of the  
5 teeth 54 and the vertical portion 38 of the teeth 36 are opposed and mutually contacted, resulting in that a state of mating of the teeth 54 at the side of the brake-locking member 5 with the teeth 36 at the side of the tape reel 3 becomes hard to become unfitted and an expected rotation  
10 can be securely prevented. Thus, because a function for preventing a tape from being loosened when the tape is preserved or the like, can be sufficiently performed, folding and/or jamming of a magnetic recording tape at inside of the case can be prevented in advance.

15 Further, even when the tape cartridge receives an impact at the time of dropping of the cartridge or the like, a state of mating between the teeth is hard to become unfitted, resulting in that the loosening of the magnetic recording tape is hard to occur. Further, as shown in below-mentioned  
20 Fig.6, the height of each of the teeth 54 and the teeth 36 can be set to be lower.

Further, as above-mentioned, when the teeth 54 and the teeth 36 are about to be mutually mated by a biasing force of the brake-locking spring 4, the tip end 55a of each  
25 of the teeth 54 and the tip end 37a of each of the teeth 36 are respectively abutted on the taper portions 37, 55, simultaneously introduced and moved to a gap between the

teeth and the other teeth, resulting in that the mating of the teeth with the opposite teeth can be readily and securely performed.

Further, at each of the taper portions 55, 37 and each  
5 of the vertical portions 56, 38, a sectional area of each of the teeth seen from Fig.5 can be secured larger than conventional, so that the strength of the teeth can be enhanced. Particularly, more splendid strength can be obtained than  
10 conventional in the vicinity of the tip parts 55a, 37a of the taper portions 55, 37. Therefore, even when the tape cartridge receives a strong impact by its dropping or the like, breakage of the teeth is hard to occur.

Next, when the tape cartridge is mounted to the recording and reproducing apparatus, as shown in Fig.3, the  
15 driving member 85 at the side of the apparatus and the tape cartridge relatively approaches each other, and the driving member 85 penetrates through the penetrating hole 21 of the lower case 2. Thereafter, when the driving member 85 magnetically absorbs the metal plate 34 made of soft magnetic  
20 material at the side of the lower surface 32a of the hub portion 32, the teeth portion of the driving member 85 is mated with the engaging teeth 34a of the hub portion 32. Further, the projecting portion of the teeth portion of the driving member 85 allows the brake-releasing member 6 to  
25 be moved in a direction of an arrow B' (which is opposite to the direction of the arrow B (see Fig.2) using the leg portion 6b, resulting in that the brake-locking member 5

is moved against the biasing force of the brake-locking spring 4 by a constant stroke to arrive at a non-locked position as shown in Fig.3, resulting in that there occurs a gap between the teeth portion 51 and the teeth portion 35 and then the mating state of the teeth portion 51 with the teeth portion 35 is released. Thus, the tape reel 3 can be rotated together with rotation of a driving axle 86 of the driving member 85.

Further, a door member 7 is opened by an opening member (unshown) at the side of the apparatus, the leader members 8 are held by the holding member at the side of the apparatus, and the magnetic recording tape is drawn toward the side of the apparatus, resulting in that recording or reproducing of the magnetic tape becomes possible.

Next, description will be explained about a gap between the teeth portion 51 and the teeth portion 35 in the tape cartridge shown in Fig.1 to Fig.5, referring to Fig.6.

Fig.6 is a view showing a gap formed between the tip part 55a of each of the teeth 54 of the teeth portion 51 and the tip part 37a of each of the teeth 36 of the teeth portion 35 at the time of releasing the mating state of the teeth when the tape cartridge is used, comparing such a gap with the gap formed in the conventional art in Fig.11B.

As above-mentioned, the tape cartridge is mounted to the recording and reproducing apparatus; the brake-locking member 5 is moved by a desired stroke; the mating state is released; and the tape reel 3 can be rotated. Then, as shown

in Fig.6, a gap b between the tip end 55a of each of the teeth 54 of the teeth portion 51 and the tip end 37a of each of the teeth 36 of the teeth portion 35 is set to be larger than the gap a in the conventional configuration shown in Fig.11B and the heights of each of the teeth 54,36 are configured to be lower while the moved stroke by the brake-locking member 5 is constant.

While the tape reel 3 is being rotated, the brake-locking member 5, as shown in Fig.3 and Fig.4, is biased by and contacted with the brake-releasing member 6 using the brake-locking spring 4 at the convex bearing portion 52 located at the center portion. Even if the brake-locking member 5 is inclined by receiving an affection based on pressure balance of the brake-locking spring 4, as shown in Fig.6, the gap b between the teeth 54 and the teeth 36 is larger than conventional. Thus, contact between the teeth 54 at the side of the brake-locking member 5 and the teeth 36 at the side of the rotating tape reel 3 can be securely avoided. And an operational defect is hard to occur based on the contact between the teeth, and further an error operation can be securely avoided at the time of reproducing and/or recording information. Thereby, reliability can be enhanced while the tape reel 3 is being rotated.

As above-mentioned, even if height of each of the teeth 54 and the teeth 36 is set to be lower in order to securely widen the gap b between the teeth 54 and the teeth 36 when the tape cartridge is used, the mating state of each of the

teeth 54 at the side of the brake-locking member 5 with each of the teeth 36 at the side of the tape reel 3 is hard to become unfitted when the tape cartridge is not used, by the mating configuration of the teeth 54 with the teeth 36 at the taper portion and the vertical portion and further the sectional areas of the teeth 54 and the teeth 36 are larger, resulting in that there does not occur any problem to be caused by such a configuration that height of each of the teeth 54 and the teeth 36 is set to be lower.

Further, even if the bearing portion 52 used for the brake-locking member 5 and the brake-releasing member 6 are contacted and worn in a biased state while the tape reel 3 is rotating, as above-mentioned, the gap b between the teeth 54 and the teeth 36 is large, resulting in that allowance degree against a worn amount becomes more, so that less problem occur as conventional.

Additionally, a pitch between the teeth may be made to be large in order to enhance strength of the teeth in such a conventional configuration as shown in Fig.11A. According to this configuration, the loosening of the tape occurs when the teeth are mated with the opposite teeth and the tape is tensioned and extended. On the other hand, a span of the pitch may be made to be narrow, in other words, an angle of tip part of each of the teeth may be made to be more acute so that the mating of the teeth with the opposite teeth becomes hard to be unfitted, and the loosening, the pulling, and the extension of the tape are prevented.

According to this conventional configuration, especially a portion at the vicinity of the tip end is thin thereby having a weak configuration in its strength. However, according to the teeth configuration of the present  
5 embodiment, strength of the teeth can be secured, and further the securing state of a sufficient span of the gap between the teeth when the tape cartridge is used can be secured and the loosening of the tape can be securely prevented.

Next, description will be explained about a modified  
10 example of the teeth configuration in which the height H of a vertical portion of each of the teeth is altered, referring to Fig. 7 and Fig. 8. Fig. 7 is an elevational view illustrating a modified example of a teeth construction in which the height H at a vertical portion of each of the teeth is set so as  
15 to be somewhat lower in a same way as shown in Fig. 5. Fig. 8 is an elevational view illustrating another modified example of a teeth construction in which the height H at a vertical portion of each of the teeth is set so as to be somewhat higher in a same way as shown in Fig. 5.

20 In the example of Fig. 7, the height H of the vertical portion 56 is set to be somewhat lower. However, it is preferable that the height H is equal to or 60% higher than the entire height H1 of each of the teeth 54. This relationship can be applied to the teeth 36. Thus, in the  
25 opposing portions c at the vertical portions 56, 38, the opposing areas can be secured, resulting in that it can be prevented that the mating of the teeth with the opposite



teeth is unfitted when the tape cartridge is not used.

Further, in the example of Fig.8, the height H of the vertical portion 56 is set to be somewhat higher. Here, it is preferable that the height H is not 95% higher than the entire height H1 of the teeth 54. This relationship can be also applied to the teeth 36. Thereby, at opposing portions d at the vertical portions 56, 38 in Fig.8, the opposing areas can be secured so as to be larger than those in the case of Fig.7 while inclined angles can be secured to some extend at the taper portions 55,37, resulting in that a guide effect can be performed by the taper portions.

As above-mentioned, the present invention has been explained together with the embodiments. However, the present invention is not limited to them. Namely, various modifications can be carried out without departing from the scope of technical idea of the present invention.

For example, the tape cartridge is not limited to the one-reel typed one. Needless to say, any other type of a tape cartridge can be applied thereto.

Further, the configurations in Fig.5, Fig.7, and Fig.8 are set so that height H of the vertical portion 38 of the teeth 36 is equal to height H of the vertical portion 56 of the teeth 54. The present invention is not limited to these configurations. For example, a configuration is set so that the heights H1 of the teeth 36, 54 are constant while the heights of the vertical portions 38, 56 are not equal. Fig.9 is an elevational view illustrating further another

modified example of a teeth construction in which height  
Ha at a vertical portion of each of the teeth construction  
is changed by a teeth portion 35 and a teeth portion 51 in  
a same way as shown in Fig.5. In an example of Fig.9, the  
5 height Ha of the vertical portion 38 of the teeth 35 at the  
side of the tape reel 3 is set to be somewhat lower than  
height Hb of the vertical portion 56 of the teeth portion  
51 at the side of the brake-locking member 5. According to  
this configuration, opposing areas can be secured at opposing  
10 portions e while a guide effect can be performed at apex  
portions of the tip parts at the taper portions 55,37.

Further, Figs.12A to 12D show modifications of shaping  
of each of teeth. In Fig.5, and Figs.7 to 9, the tip part  
of each of the teeth is formed at its apex, and abutted on  
15 a base portion in a point contacting state. However, in an  
example of Fig.12A, a flat portion 91 is provided at a tip  
part of each of the teeth. When the teeth are mated with  
the opposing teeth, the flat portion 91 is abutted on the  
bottom surfaces 39a, 57a (see Fig.5) of the base portion  
20 of the opposing teeth portion in a linear contacting state  
or in a plane contacting state. Note that in this case, the  
flat portion may be slightly inclined as represented by a  
dotted line so that an apex 91a is contacted on the base  
portion in a point contacting state.

25 In the example of Fig.12B, the configuration is  
constituted so that a taper portion 92 and a taper portion  
93 of each of the teeth are not symmetrical with respect

to a longitudinal direction axis line from a tip part 94 to the base portions 39, 57 (see Fig.5). In this case, the tip end 94 may be formed in a flat manner as shown in Fig.12A.

In the example of Fig.12C, the configuration is constituted so that a taper portion 95 of each of the teeth is inclined from one of the both ends of the tip part 96a, and a vertical portion 97 is extended from a tip part 96a to the bases 39, 57 (see Fig.5). And the configuration is constituted so that the vertical portion 98 from a terminal end 96b of the taper portion 95 is extended to the base portions 39, 57 (see Fig.5). In this case, the tip part 96a may be provided with a flat portion 99 as shown in Fig.12D.

Further, Fig.13 shows further modified example of shape of each of the teeth. The example of Fig.13 is made so that a vertical portion of each of the teeth is slightly inclined to the base portion, and the mutual tip parts are not contacted with a bottom surface of the base portion at the opposite side while the vertical portions are mutually contacted. A vertical portion 138 of a tooth 136 of a teeth portion 135 is inclined by an angle  $\theta$  with relative to a vertical line h from a terminal portion 137b of a taper portion 137 toward a base portion 139. Likewise, a vertical portion 156 of a tooth 154 of a teeth portion 151 is inclined by an angle  $\theta$  with relative to a vertical line h from a terminal portion 155b of a taper portion 155 toward a base portion 157. Owing to the inclination, when the teeth portion 135 is mated with the teeth portion 151, the vertical portion 138 of the tooth

136 is contacted with the vertical portion 156 of the tooth 154 while the tip part 137a of the tooth 136 and the tip part 155a of the tooth 136 are not respectively contacted with the bottom surfaces of the base portions 139, 157.

5           Further, in Fig.13, it is preferable that a contacting height (projected height of the vertical line h)  $\Delta H$  at an opposing and contacting portion f between the vertical portions 138, 156 is equal to or 20% higher than and equal to or 90% lower than the entire length H1 of each of the  
10 tooth 136 and the tooth 154. Thereby, the opposing areas can be sufficiently secured at the opposing and contacting portion f. Further, for example, the inclination angle  $\theta$  can be set by 1 to 2 degrees.

          Further, at the time of mating of the teeth with the  
15 opposite teeth, the tooth 136 of the teeth portion 135 and the tooth 154 of the teeth portion 151 need not to be mutually mated over all the mating portions in the circumferential direction. Namely, such a mating state has only to be established at a mere part of the mating portions therein.

20           According to the tape cartridge of the present embodiment, when the tape cartridge is not used, the mating state of the teeth at the side of the brake-locking member with the teeth at the side of the tape reel is hard to be unfitted, resulting in that unexpected rotation of the tape  
25 reel can be securely prevented, the loosening of the tape is hard to occur, and the strength of the teeth can be enhanced.

          Further, a gap between the teeth at the side of the

tape reel and the teeth at the side of the brake-locking member can be secured so as to be as wide as possible, resulting in that the contact between the teeth at the side of the tape reel and the teeth at the side of the brake-locking member can be securely prevented, so that an error operation can be prevented.